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ABSTRACT

Overviews of schema theory, which focuses on the cognitive operations engaged in by the reader, and discourse analysis, which focuses on structural characteristics of the text itself, are presented in this paper. The first section explains the notion of cognitive schemata (patterns of expectations that are applied to incoming information) and discusses six essential constituents of schema theory: schema states; schema variables; instantiation; activation; episodic, semantic, and schematic memory; and high versus low integrity processing. It then presents insights into the verbal learning process that can be drawn from schema theory. The second section traces the roots of discourse analysis and discusses the following forms: cohesion analysis (which is closely associated with the surface structure of the text), propositional analysis (in which the text is analyzed in terms of semantic content rather than linguistic form), and story grammar (which attempts to define broader relations among broader segments of text than the other two techniques). (GT)

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Frameworks for Examining Comprehension and Discourse: An Overview

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Recent developments in cognitive psychology, linguistics, psycholinguistics, and information theory have suggested a variety of alternative approaches to the analysis of the processing and comprehension of connected discourse. These approaches, and the theoretical considerations underlying them, promise to yield new insights into the question of how people learn from reading prose materials. Studies in this area focus upon issues in comprehension, cognition and memory, and the interrelationships among these mental operations.

The purpose of this paper is to provide the reader with a very basic overview of some of the main concepts now being developed in this area. While there is not a great deal of direct application of these concepts to college level reading instruction at the present time, the ideas we discuss can be expected to produce significant impact during the next few years.

These developments may be broadly divided into two areas of emphasis. One of the areas focuses on the cognitive operations engaged in by the reader. The second focuses on structural characteristics of the text itself.

I. Schema theory: Emphasis on the Reader's Role

Concept of a schema

Recently several researchers have focused on the notion of cognitive schema as a useful concept around which to organize hypotheses of comprehension and memory. The term is used in much the same way that Kant employed it in the eighteenth century and Piaget has developed it in his writings. A schema is a pattern of a concept, object or event -- the basic outline which determines how that entity will be realized in concrete terms. It is an abstract or generic description applicable to whatever entity is subject to comprehension, composed of constituent elements, each of which is a "slot" or "placeholder" to be filled in by particular information (Anderson, Pichert, Goetz, Schallert, Steven & Trollip, 1976; Anderson, Reynolds, Schallert, & Goetz, 1976).

Each individual operates with his own set of schemata, developed from experience and learning. For example, an auto mechanic will have a more detailed schema for understanding a distributor than an average driver in the sense that he has a more richly structured concept that provides a greater number of slots to be filled in with relevant information. The average driver, in turn, if he knows something about the location and function of a distributor, will possess a more functional schema for this object than a person who has never looked under the hood of a car.

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A schema describes the structure of what one knows or believes that he knows. A religious fundamentalist probably operates from a well-structured schema for the biblical concept of creation, while a genetic researcher or physical anthropologist has a strong schema for evolutionary theory. What this notion says, in effect, is that we apply acquired patterns of belief to information and interpret (or reject) it accordingly, although information can affect the pattern in turn. The fundamentalist, apply his schema to certain kinds of evidence, might conclude that ancient bones were planted in the earth by a knowing hand to fool the faithless, while the physical anthropologist might dismiss the six-day creation account as a myth. In a crisis, nevertheless, the latter might also turn to religious beliefs and thus open his schema to elements not accountable by science.

Rumelhart and Ortony (1976) have compared a schema to a play that is realized anew with each enactment. They also call schemata "data memory" (p. 101). These are not linguistic entities but more basic representations of knowledge whcih are expressed in language. "The purpose of a schema," they write, "is that of a cognitive template against which new inputs can be matched and in terms of which they can be comprehended" (p. 51).

Components of schema theory

The basic notion of a schema as a pattern of expectations to be applied to incoming information is simple enough and seems intuitively sound. What is interesting is the way in which schema theorists have developed the concept into a model of cognitive activity subject to experimental testing. Among the essential constituents of this concept (itself an exemplar of a high level schema with several embedded schemata or sub-concepts) are the notions of schema states, schema variables, instantiation, activation, episodic and semantic memory, and high and low integrity processing. Each of these terms is described briefly below in an effort to show how schema theory has been elaborated into a rationalization of the thinking process relevant to the issue of school learning.

State of Schema: This is the sub-set of information related to a particular schema (or set of interacting schemata) on a particular occasion. Examples are particular details from a story, general impressions, summary statements, and rules for drawing inferences (Spiro, 1976). This schema state can be altered over time, especially when new information is introduced. Thus, a reader who invokes a particular schema state in response to a report of a dangerous crime suspect at large will have the state altered by subsequent information regarding this suspect's innocence. He may even recall the original information differently: instead of recalling that a dangerous person was being pursued, which is what he originally believed, he will recall that someone was erroneously identified as dangerous. This kind of alteration of memory, crucial to reconstructive theory, has been experimentally investigated (Spiro, 1975, 1976).

Schema Variables: As stated, particular values are assigned to the constituents of a schema. These "slots" or "placeholders" are the variables within the pattern which admit appropriate information. The values which can be assigned to variables are constrained by context (construed in the broadest sense to include any environmental factor). Yet the constraints are flexible (Rummelhart

& Ortony, 1975). As an example, a schema for the concept of animal may include the variables of living, free-moving and reproducing, to be filled in by particular values or realizations of each of these properties. Yet a stuffed owl is also considered an animal although it is dead, immobile and cannot be induced to lay an egg. Or a man may be called an animal not in the zoological sense but because of certain undesirable behaviors, in which case the schema for animal has been temporarily altered to include only certain negative values. Understanding such instances, it seems evident, requires the evocation of a context that goes well beyond the language employed.

Instantiation: When values are assigned, the schema or schema constituents are said to be instantiated. Applying this concept to words, Anderson, Pichert, Goetz, Schallert, Stevens and Trollip (1976) point out that context and processing give a word a particular meaning each time it is used, which is to say that the word is instantiated. Instantiation is an inferential process based on probabilities of context under the influence of governing schemata. In this way, situation, text and reader collude in the assignment of meaning. For example, the main verb in the sentence, "the man bit off more than he could chew", would be instantiated differently depending on whether was a pie-eating context or a case of polygamy. Or a phrase like "abstractive trace retrieval theory of discourse memory" will be instantiated in accordance with one's familiarity with memory research.

Activation: Ortony (1977) describes this idea to account for what happens when a concept is processed. To understand it one must first accept the notion of a network organization of knowledge in which particular concepts, or perhaps better the schemata of particular concepts, represent "nodes" or significant junctions. During the processing of a concept, activation is spread out through the network with decreasing intensity, probably reaching some other concepts and providing access to their internal schemata too. This notion may be exemplified in the common experience of thought association. The phrase "cholesterol level", for example, may arouse a network of implications related to the processor's age, weight, circulatory problems, awareness of current health fads, and so on. The subset of concepts or nodes activated constitutes the "final activated subgraph", which is the basis of inference used in comprehension. That is, an associationist process is proposed to account for the experience of one concept suggesting another. This image of a knowledge network with certain important junctions is limited in some respects but does help to characterize the assumed interrelatedness of all stored knowledge.

Episodic, Semantic, and Schematic Memory: Spiro (1977) proposes three kinds of levels of memory, each more durable than the last. Least durable is surface memory, or memory for the exact construction of any input (say a sentence) as it was presented. Next is semantic memory, a relatively stable store of meanings, but these too can be lost or altered over time. Last to go, generally, is the representation of the "final activated subgraph" of concepts -- the set of schemata called up during activation.

As an example, one might read the sentence, "It's too tough and scary business, but it's also loaded with high spirits and lively people and applause and a chance to say to the world, 'Hey! Here I am.'" Assume that the reader is

aware of the speaker's life as a television actor and furthermore that he dislikes the speaker: this is context in which he reads the statement. The surface representation of the sentence will probably fade as soon as the reader has stopped looking at it. He may be able to paraphrase the remark, however, something like this: "He says that he gets scared but has fun, especially when he gets a lot of recognition, because he wants the world to see him". After an interval of time the reconstruction may be something like this: "He made an egotistical statement typical of actors". From the last, we might assume that at least two concepts were activated during the reader's processing of the sentence -- the egotism of a person who would make such a statement and the nature of a typical actor's statements. These remained after the surface and semantic representations of the statement themselves had faded away.

This example also serves to distinguish between episodic and semantic memory. In the case described, the reader remembered an episode rather than a meaning -- the episode of a disliked person making a fatuous statement. Had the reader been a devoted fan of the actor, perhaps he might have internalized the meaning of the statement (e.g., believed it) rather than the episode of reading it. In that case, he would have, as part of his belief system, the information that television acting is frightening but pleasurable, etc. Semantic memory, according to Spiro (1977), represents what a person believes to be true, while episodic memory is an autobiographical accounting of events. Information is transferred from episodic memory to semantic memory if it can stand alone, as, for example, in the case of a highly credible speaker. Thus, the biblical account of creation is in the semantic memory of the fundamentalist, while evolutionary theory crops up as an episode with which he must deal on occasion. It has not passed his test of truth.

High/Low Integrity Processing: This distinction (Spiro, 1976) is useful in looking at the different strategies a person might employ in trying to remember something. Suppose, for example, he is a participant in a memory experiment and wants to do well. In this case, the item he is trying to remember will have "high integrity" and he will isolate it from his other knowledge in an effort toward verbatism recall (or maintenance of surface memory). Usually, the item will have no value for him other than to demonstrate his ability to recall and will not be retained after the completion of the task (Anderson, 1977). Now suppose that this person is reading an article on a subject of interest. In this case, his objective is to update his own knowledge on this subject, and the material itself is of less importance than its relationship to what he knows and/or wants to know. The latter is called "low integrity processing" and involves masimum interaction of new information with existing schemata. One might say that the material has less integrity than the knowledge system to which it is being related. Thus, in high integrity processing the cognitive processes are subordinated to the material, and in low integrity processing, the material is subordinated to the individual's need for relevant and useful knowledge.

Spiro (1976) considers low integrity processing to be the normal condition and high integrity processing a special case. In low integrity processing, schema states are altered by a variety of factors, including prior linguistic context, context of situation, speaker-hearer (writer-reader) relationships,

interests, attitudes, task demands, linguistic cues, and kind of discourse. In high integrity processing, on the other hand, nothing much happens because the normal cognitive processes are "frozen: in an effort to maintain the integrity of the input.

The Nature of Learning

Learning, according to schema theory, consists of updating knowledge, that is, modifying existing schemata and creating new ones (Anderson, 1977). This process operates most smoothly when the learner is able to subordinate incoming information to existing knowledge structures and allow interaction to take place. However, when the integrity of the text takes precedence over the conceptualizing activity of the learner, and he is directed to maintain the input in as unaltered a form as possible, he will be able to do so only by isolating the processing task from his normal intellectual functioning. This freezing of the normal cognitive processes is likely to occur in memory experiments and some classroom learning tasks, where the concern is with accuracy of text recall (Anderson, 1977; Spiro, 1975). According to schema theory, such information would have little functional importance for the learner in his concern for updating his own knowledge and so would result in little long-term learning.

The indictment of traditional formal education procedures implicit in this interpretation of schema theory needs to be examined with caution, of course. Those charged with the responsibility of helping students cope with academic tasks cannot expect to change the nature of the tasks themselves, even assuming that one could derive a sound curriculum theory from a limited set of observations on the nature of memory and its relationship to long term learning. We must keep in mind, moreover, that the approach described here is a theory, not a thoroughly validated set of conclusions. Nevertheless, one can use the insights provided by schema theory in the planning of approaches to helping students deal with college texts.

Two fundamental principles concerning learning from verbal sources that can be drawn from schema theory are these:

1. New information must always be related to what the learner already knows, and

2. the acquisition of knowledge through reading requires active, structuring operations upon material by the reader, who must in some way engage his schemata with those of the writer.

These principles give new depth to the concepts of previewing, purpose-setting and question posing that are frequently recommended as study techniques. Also, the value of rephrasing and restructuring information is emphasized. Comprehension is seen as something more than just understanding; "processing" may be a better term. Long range learning, by which we mean the cognitive development that takes place over time, is characterized by the ability to express and apply knowledge and concepts in varying situations. Therefore, the learner should concentrate on processing information into the complex network of knowledge he already posesses.

When information is unfamiliar, this processing may require the employment of conscious strategies for setting up meaningful frameworks and going beyond the language of the text to derive meaning in one's own terms. What this probably means in terms of learning assistance programs is that primary emphasis should be placed on activities which encourage students to abstract the structure of meaning from a text, to rephrase concepts in their own words and discuss them in their own frameworks of meaning, to relate specific items of information to general concepts, to reduce large segments of information to cues, and to practice reconstruction of information from these cues.

The instructor occupies a kind of mediating position between the reader and the text. If reading can be viewed as an interaction between the cognitive schemata of the reader and those of the text writer, then logically it is the instructor's role to be aware of the text features which represent the writer's schemata and assist the reader in coming to terms with them. The next part of this discussion, therefore, will deal with ways of examining the semantic or meaning structures of text materials.

II. DISCOURSE ANALYSIS: Focus on Textual Features

Another important area of investigation for reading researchers has focused on the structure of the text. This area, most often known as discourse analysis, seeks to provide an objective description of connected discourse and to delineate any linguistic constants which may exist across broader segments of a text.

Broadly speaking, contemporary discourse analytic methodologies have focused on the semantic aspects of text, as opposed to more conventional approaches which have emphasized surface structure forms, especially syntax (Harris, 1955).

The instructional implications of new trends in semantic discourse analysis are many and varied, but they seem to converge most readily in the area of readability. Researchers and practitioners alike have been aware for several years that the conventional assessments of text readability, such as the Fry Graph and the Dale-Chall formula, have been inadequate at best and potentially misleading. Discourse analysis may provide a theoretically-sound technique for assessing readability and comprehensibility on the basis of semantic and stylistic features.

It seems worthwhile, then, to briefly review these new techniques and to provide at least a cursory introduction to the specific methodologies. Unfortunately, considerable confusion has surrounded and continues to surround the entire area of discourse analysis. Much of this confusion may stem from the wide variety of terms subsumed by the general technique. For example, discourse analysis is known variously as textgrammatik, text analysis, discourse grammar, and text grammar. While each of there terms applies to a specific discourse analytic technique or taxonomy, relatively few clear cut theoretical differences emerge from an analysis of the terminology. Indeed, some writers have gone so far as to suggest that discourse analysis is no longer a meaningful term. (Hendricks, 1972).

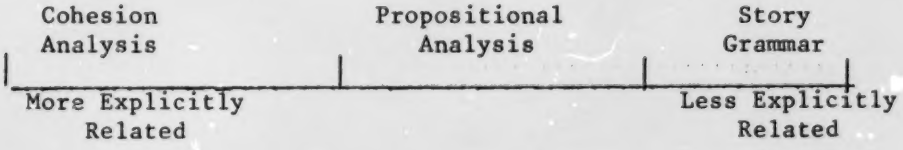
Selected Methods

For purposes of clarification, the suggestion made here is that a few well-known but highly individual forms of discourse analysis be considered as representative of the wide variety of available techniques. The techniques chosen for consideration here are (1) semantic cohesion analysis (Halliday and Hassan, 1976), (2) semantic propositional analysis (Kintsch, 1975; Kintsch and van Dijk, 1977), and (3) story grammar (Stein, 1976 and 1978).

Before considering each of these systems separately, it seems worthwhile to consider the manner in which they are related. One such structure has recently been proposed (Rhodes, 1978) in which the methods are considered on the basis of their degree of relation to the original surface structure of the text. When viewed from this perspective, it is possible to place the methods in a logical order on the continuum. This notion is graphically represented in Figure 1. For example, since cohesion analysis is most closely associated with the surface structure it would be placed at the far left end of the proposed continuum, whereas story grammar - since it rarely if ever deals with the actual linguistic structures of the text - is placed at the far right. Propositional analysis, at least the type suggested in the work of Kintsch and van Dijk, lies somewhere between the two other techniques. As noted above, and at this stage this point cannot be over-emphasized, all three analytic modes are essentially semantic techniques. But their individual associations with the surface structures do vary considerably.

Figure 1

CONTINUUM: RELATIONSHIP OF TECHNIQUE TO SURFACE STRUCTURE



Each of these analytic modes does fulfill a unique role in the analysis of a text. This function appears to be directly related to the relative position of the technique on the proposed continuum.

Despite their basic similarities as modes of semantic discourse analysis, each of these techniques represents a disparate point-of-view regarding significant aspects of language processing and comprehension. In short, each reflects a different intellectual tradition and a different perspective on what is important in connected discourse.

The Roots of Discourse Analysis

It seems possible to trace the roots of discourse analysis to the classical Greek concern with the form of a text, especially oratory, as exemplified by the sophists. This tradition persisted throughout much of Western intellectual history, represented in the conventional Occidental concern with rhetoric,

and oratory. More specifically, however, the methodological roots of discourse analysis apparently stem from the philosophical and linguistic concerns of what might be termed the "structuralist" school of thought, exemplified by such scholars as Ferdinand de Saussure (1959), Jean Piaget (1970), and Claude Levi-Strauss (1963).

This structural point-of-view is reflected in several ways among the modes of discourse analysis under consideration here. First, there is the paramount importance of the text as a whole and meaning-based semantic unit. Second, there is the attempt to specify the relationships among the various components of the text. Finally, there is the concern for defining the rules governing the relations of the various segments of the text to the discourse as a whole. Each of these aspects of the methods reflects an important consideration from the structuralistic perspective.

Perhaps more importantly, however, this commonality would help to explain how three widely divergent modes of analysis can be grouped under the general heading of "discourse analysis". As noted above, each of these methods represents a different discipline or tradition: cohesion analysis stems from a literary or rhetorical traditon, propositional analysis emanates from a straightforward linguistic tradition, and story grammar grows almost directly out of the concerns of anthropology, especially folkloristics. Yet, as outlined above, all three share fundamentally important common goals and concerns.

Cohesion Analysis

The semantic cohesion schema proposed by Halliday and Hassan (1976), for example, stems from a literary/rhetorical tradition in which stylistics is a basic concern. Halliday and Hassan are essentially interested in defining those attributes of connected discourse which differentiate a text from a non-text. They suggest that these attributes are separable into two intersecting areas: register and cohesion.

Register defines what might be termed the sociolinguistic aspect of a text. It is further refined into field, mode, and tenor in an attempt to fully describe the setting and affective environment in which the printed text occurs. At this time, register is a somewhat amorphus concept, one which becomes difficult if not impossible to operationalize in practice.

Cohesion, on the other hand, provides the analyst with a readily assimilable categorical analytic mode which is relatively easy to operationalize. The general assumption which seems to form the theoretical underpinnings of cohesion analysis is that the essential characteristic of a text - whatever that text may be - is that it is internally cohesive; e.g., that the text in some way "hangs together" as a structural-semantic unit.

The cohesion schema attempts to codify those semantic structures which provide for this cohesion. Halliday and Hassan suggest that it is possible, using their taxonomy and coding system, to rigorously describe and quantify those features of a text which aid in establishing its cohesive quality.

The basic unit of cohesion is, according to this schema, the cohesive tie: a semantic relation between items which is crucial to the semantic interpretation of one of the items and, consequently, to the text.

Halliday and Hassan suggest a fairly elaborate coding method for detailing the kind and degree of cohesive ties in a text. They suggest that cohesive ties may be accorded to one of several categories: reference, substitution, ellipsis, conjunction, or lexical cohesion.

Note the following sentences:

(1) Wash and core six cooking apples.

(2) Put them in a fireproof dish.

There is a rather obvious cohesive tie between the two sentences. The tie is formed by the relation between "apples" in sentence (1) and "them" in sentence (2). Halliday and Hassan code this particular kind of cohesive tie as a reference with a distance of 0 because no sentences intervene between the presupposed and cohesive items (1976, p. 3).

This is an admittedly simple example of cohesion analysis, but it does serve to illustrate the method. It seems fair to suggest that we can learn a good deal about the semantic structure of connected discourse by applying this technique and comparing it with reader performance criteria. As Halliday and Hassan note: "the concept of a tie makes it possible to analyze a text in terms of its cohesive properties, and give a systematic account of its pattern of texture" (1976, p. 4).

Propositional Analysis

A second representative discourse analytic technique is that offered by Kintsch and Kintsch and van Dijk. Often called propositional analysis, this technique stems directly from the case grammars of Fillmore (1968, 1971) and Gruber (1969). Like cohesion analysis, the method is objective and semantic in nature: it attempts to analyze a text on the basis of "propositions" and their relations. Propositions, as considered here, represent conceptual semantic units which are formed around a predicate -- most frequently a verb or verb-related concept -- and constitute what might best be termed a basic unit of the text base.

Propositional analysis is perhaps too technical and time-consuming a topic to be dealt with in depth in this paper. Basically, however, the method attempts to analyze the text in terms of semantic content rather than linguistic form (Kintsch, 1977, p. 37). The propositions are stated in terms of "word concepts", frequently but not necessarily lexical items chosen directly from the text, which represent the underlying meaning of the arguments or elements of the propositions. There are pitfalls in any system which attempts an exclusively semantic form of analysis, and propositional analysis is no exception. The results of research using the method thus far, however, have been fruitful and positive, especially

when considered on the basis of - inevitably - reader performance criteria.

Consider the following sentence:

I unbolted the door and went out.

As an illustration of the technique, this sentence would be "propositionalized" as follows:

1. (UNBOLT, A : I, O : DOOR)

2. (GO, A : I, O : OUT)

3. (CONJ : AND, 1, 2)

For purposes of clarity, word concepts - as opposed to words - are stated in the propositions in capital letters. In the first proposition, the focus is on the relation expressed in the verb "unbolt". The other elements of the propositions, or "arguments", are noted only as they relate to the predicate. Thus, "I" is the "agent" of the unbolting while "door" is the "object". The key to the system is in the appropriate labeling of the "cases" (a la Fillmore) of the arguments of the proposition as agent, experiencer, object, instrument, etc. The third proposition expresses the relation of the two earlier propositions, which are embedded in the third. Thus the relation is noted to be a conjunction (CONJ) and the identical word found in the text is repeated in the proposition. The "1" and the "2" in the third proposition indicate that the relation being expressed is that between the entire first and second propositions.

It seems clear that propositional analysis, while valuable, is necessarily a time-consuming operation, a feature attendant upon any technique which makes use of a minutiae, especially semantic minutiae which are frequently highly ambiguous in nature. Nevertheless, propositional analysis portends to be among the most highly influential techniques available for text analysis in the immediate future.

Story Grammar

The final discourse analytic technique to be discussed here is the story grammar, especially that developed by Stein (1976, 1978). Story grammar would appear to enjoy the longest and most direct history among the techniques under consideration. Taking its basic notions from the work of Propp (1928) and Levi-Strauss (1964), this technique attempts to define broader relations among broader segments of text than the two techniques previously discussed.

As noted above, the idea of a story grammar stems from an indepth analytic technique developed in cultural and structural anthropology. Both Propp and Levi-Strauss, for example, noted that certain features or characteristics of conventional myths and folk-tales seemed to extend across both languages and cultures. Propp went on to identify the story "functions" that made this possible, while Levi-Strauss attempted to further refine and articulate the original system.

Story grammar assumes significance for reading instruction in what it tells researchers about the knowledge that readers bring to the reading act. Story grammars deal with essentially meta-linguistic notions which appear to be "universal" among specific genres of narrative prose. Whether these functions exist across expository prose has not yet been determined by researchers in the area, although several investigators are allegedly at work on an answer to the question.

The story grammar research suggests that readers, even very young readers, are aware of some of the structural characteristics of story-like material. Readers apparently infer certain expectations regarding the ways in which narrative structures are "put together", on the basis of their experiences with stories already encountered, whether aurally or in print.

It seems likely that this knowledge of reader expectations could be put to important use in the teaching of reading and study skills. Stein (1977), for example, suggests that most readers have a structural model of narrative material which includes aspects of story construction such as setting, goal-setting, initiation of experience, specific categories of attempts at resolution of conflict, etc.

These categories of story structure have developed from an investigation of conventional story functions as alluded to above as they interact with reader's recall and retention - as well as prediction of the functions. The implications seem obvious and important. Mature readers may not benefit directly from this material for a considerable length of time, but the early results of research using the technique suggest that this area-like the two outlined above -- are worth investigating.

Together, schema theory and discourse analysis center attention on reading as an interaction between reader and text. This view, we believe, will lead to a deeper understanding of reading as a process involved in learning than approaches that focus on the products of reading only. The value of the cognitive approach lies in its emphasis on the experience and role of readers as they deal with the information-bearing properties of written discourse.

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